Space Weather Technical Forecast

Issued on Friday, 18 August 2023 at 00:26 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

Space Weather Forecast Headline: Chance of isolated M-flares (R1 Blackouts).

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Low with peak flare C5.1 from AR3397 at 17/1240 UTC. This is a small bipolar spot near the northwest limb. Other low common class flares were observed, however a number of these were from spots on or around either limb with only AR3405 and AR3409 flaring on the disc. The first of these is a longitudinally wide but simple region, but with a connected filament visible in SDO imagery that suggests a greater potential for flaring than would typically be expected. AR3409 is a simplifying region to the southwest of another larger sunspot AR3403. This is the largest region on the disc, with some growth of its leader spot, but currently remains stable.

No Earth-directed CMEs were detected in available imagery, with the notable coronal dimming late on 16 Aug assumed to have been reabsorbed, and all other ejecta from limb events.

Solar Wind / Geomagnetic Activity: A transition into a CIR (co-rotating interaction region) ahead of weak fast winds of negative polarity CH35 was potentially observed. Speeds remained at background, around 300-350 km/s, however density increased from below average to average levels. The total interplanetary magnetic field strength (IMF), Bt, was generally weak at 5-8nT, but increasingly erratic and strengthening slightly after 17/1600 UTC, to peak Moderate around 11nT at 17/2028 UTC. The north-south component was initially weak and variable between +6nT and -6nT, but became predominately moderately positive from 17/1630 UTC, peaking +11nT. Phi angle was initially positive (away from the Sun) but became negative (towards the Sun) from 17/1900 UTC. Geomagnetic activity was Quiet to Unsettled (Kp1-3).

Energetic Particles / Solar Radiation: GOES16 high energy (greater than 10MeV) proton flux remained largely at background, with just a very slight increase from 17/0500-0900 UTC due to an eruption on the southwest limb. GOES16 high energy (greater than 2MeV) electron flux persisted at background levels, with the associated 24 hour fluence declining. The observed fluence at 18/0000 UTC was 1.33e6 integrated pfu.

Four-Day Space Weather Forecast Summary

Solar Activity: Low activity is likely, but with a chance of rising to Moderate with isolated M-flares possible. There is the potential for a more notable active region to rotate onto the disc day 2 (19 Aug).

Solar Wind / Geomagnetic Activity: There are no Earth-directed CMEs. Ongoing enhancement is possible early on day 1 (18 Aug) due to a transition into the fast wind of negative coronal hole 35. This is forecast to be a weak enhancement, with winds peaking around 400-450km/s, before easing later day 1 and then persisting at background through the period. Quiet to Unsettled geomagnetic activity at first, with a slight chance of Active intervals. This easing later day 1, to be mainly Quiet with a decreasing chance of Unsettled intervals through the period.

Energetic Particles / Solar Radiation: High energy (greater than 10 MeV) proton flux is expected to remain at background. High energy electron flux (greater than 2MeV) is currently at

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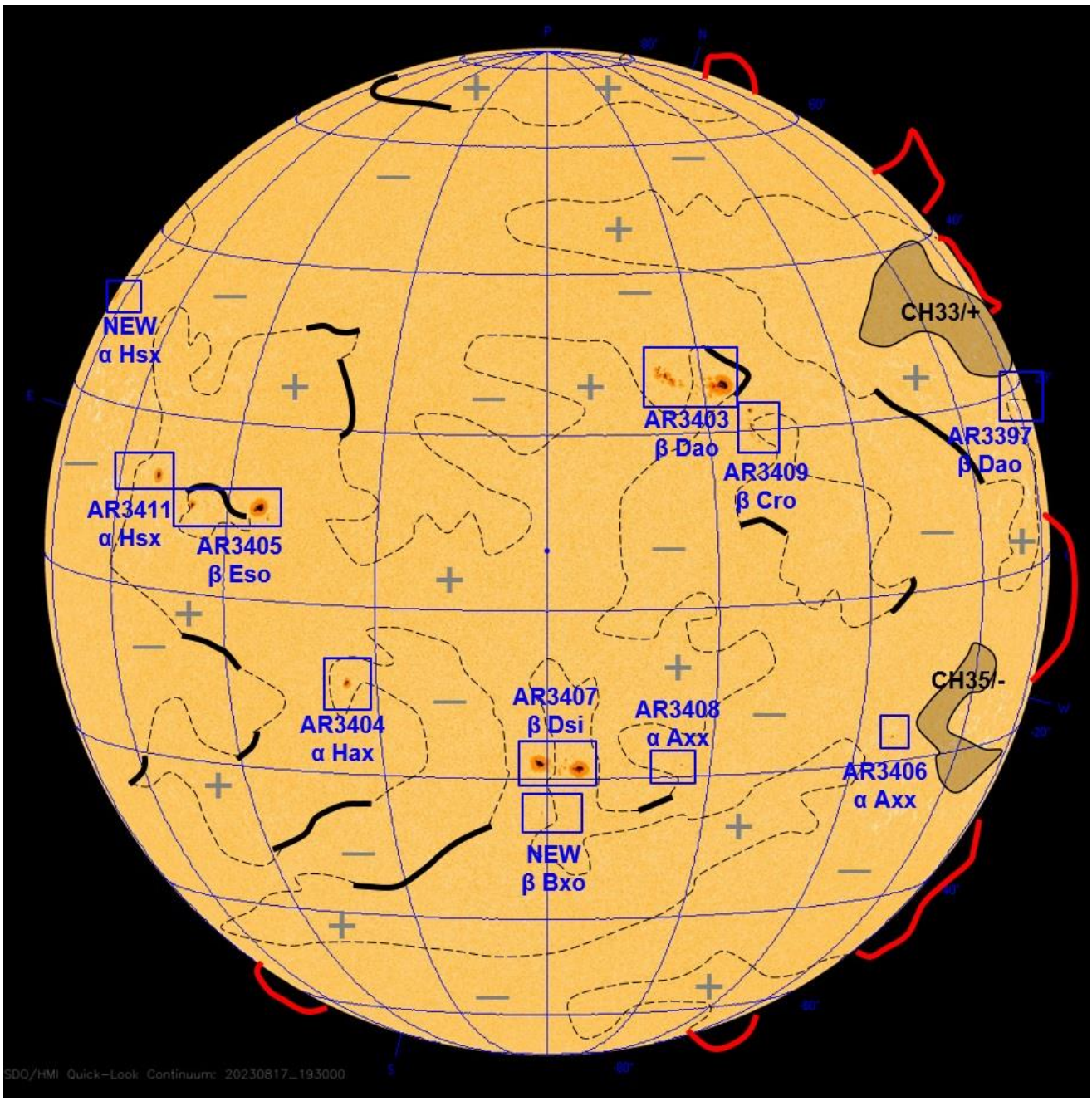
background and with only a weak enhancement expected from the current fast wind connection, and no further enhancements forecast, is expected to remain mostly at this level through the period, only increasing to Moderate at diurnal maximum. The associated 24 hr fluence is expected to persist below Active (1e8 integrated pfu).

Figure 1. Solar Analysis Valid 18/2000 UTC.



Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

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Geomagnetic Storms:

There are no Earth-directed CMEs.

A recent weak enhancement to the IMF (interplanetary magnetic field) was likely due to a weak connection to the fast wind from coronal hole 35 in the far southwest disc. This is a small feature, with any elevated winds expected to soon ease on day 1 (18 Aug). No further significant enhancements are expected through the period.

Geomagnetic activity is forecast to be Quiet to Unsettled at first, with a chance of an isolated Active interval. This soon easing later day 1 (18 Aug) to be mainly Quiet, with a decreasing chance of further Unsettled spells.

Geo-Magnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	No	1	1	1	1
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Figure 2a: Solar winds (ACE shaded, DSCOVR dark background)

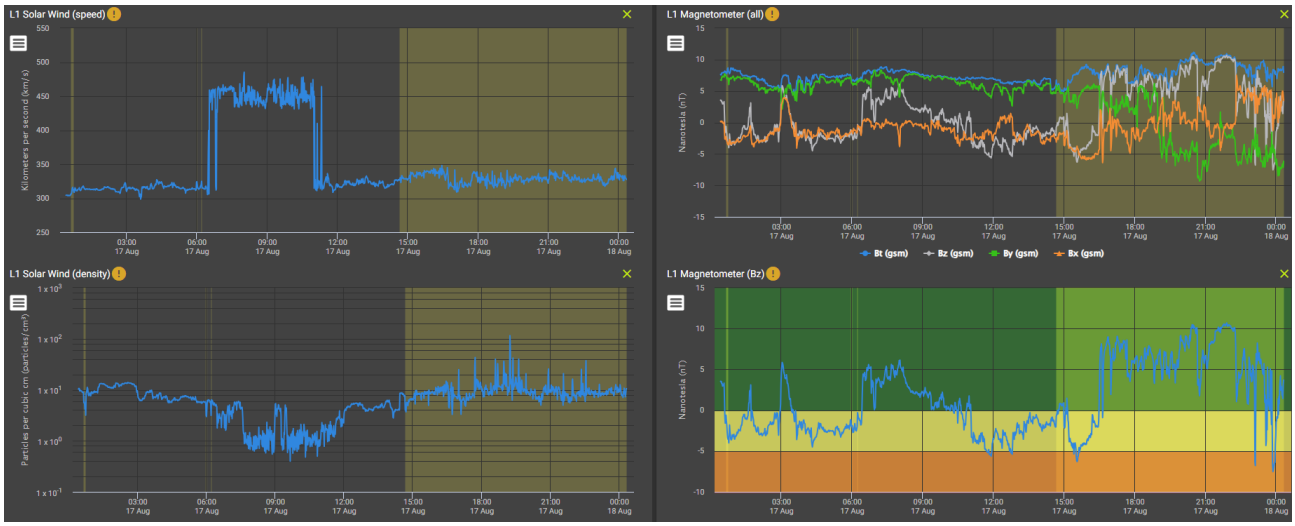

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Figure 2b: Enlil showing ongoing fast enhancement. This has not been observed, however model and reality are expected to rejoin again later in the period as any enhancement day 1 (18 Aug) eases

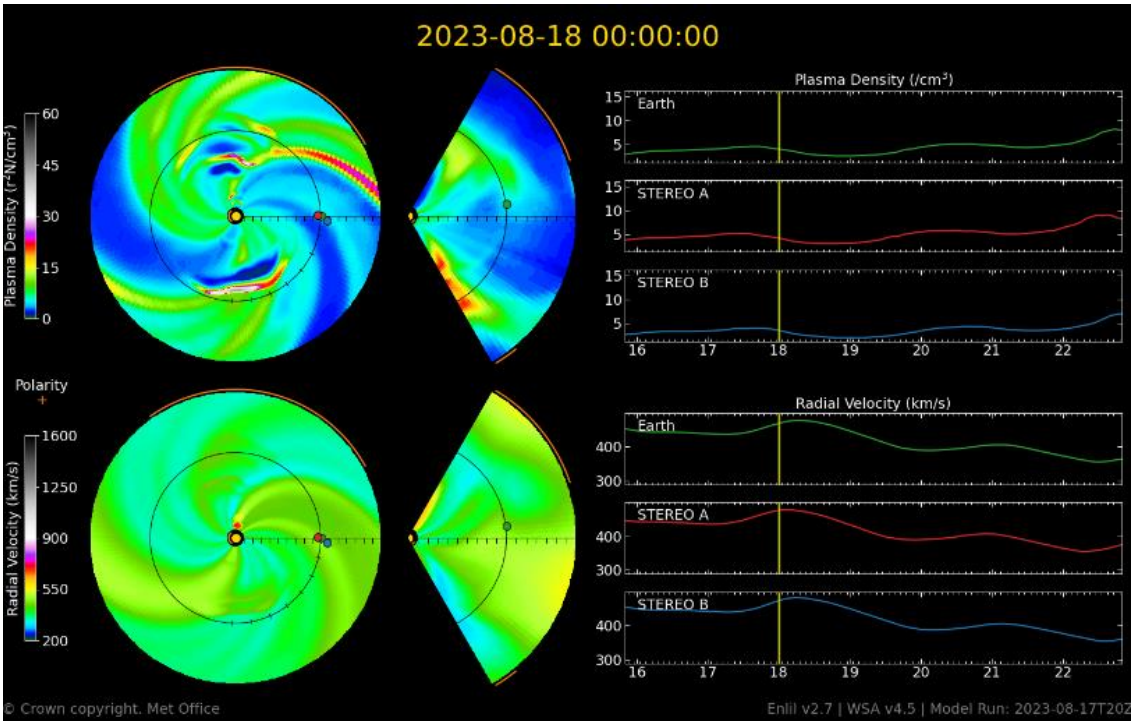
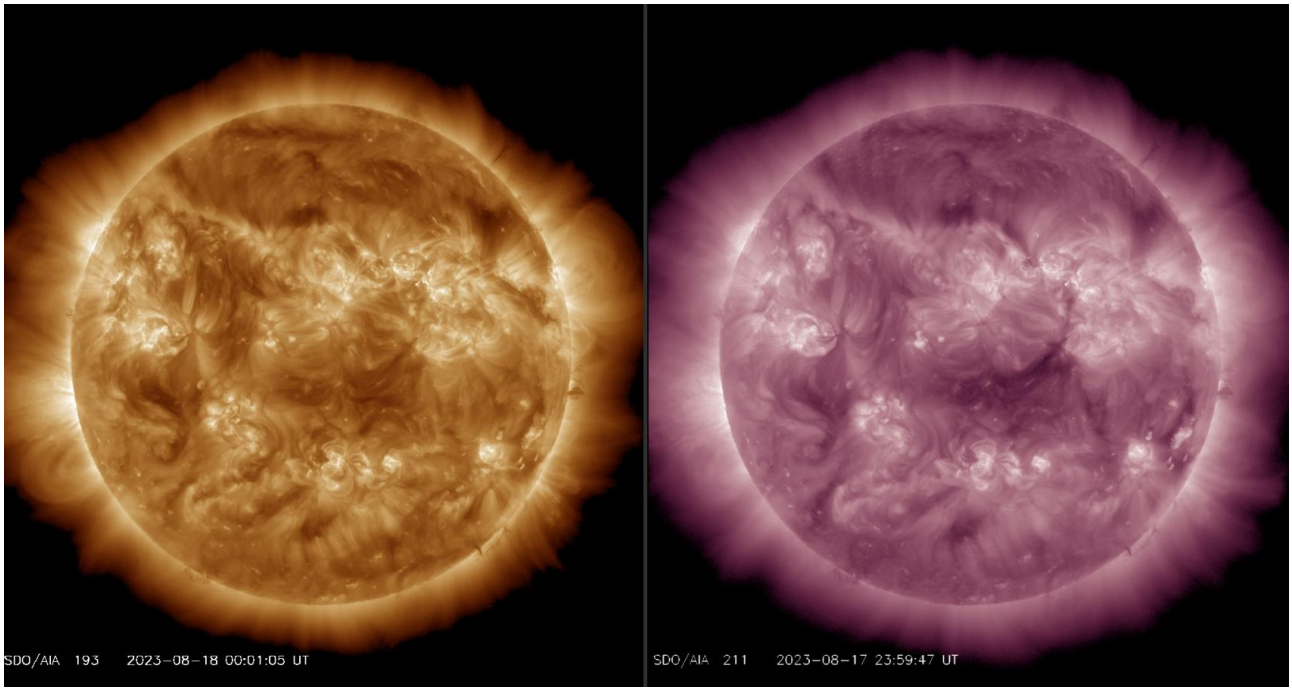


Figure 2c: SDO aia-193 and aia-211, with no further clear coronal hole enhancements expected



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Radio Blackouts - X-Ray Flares:

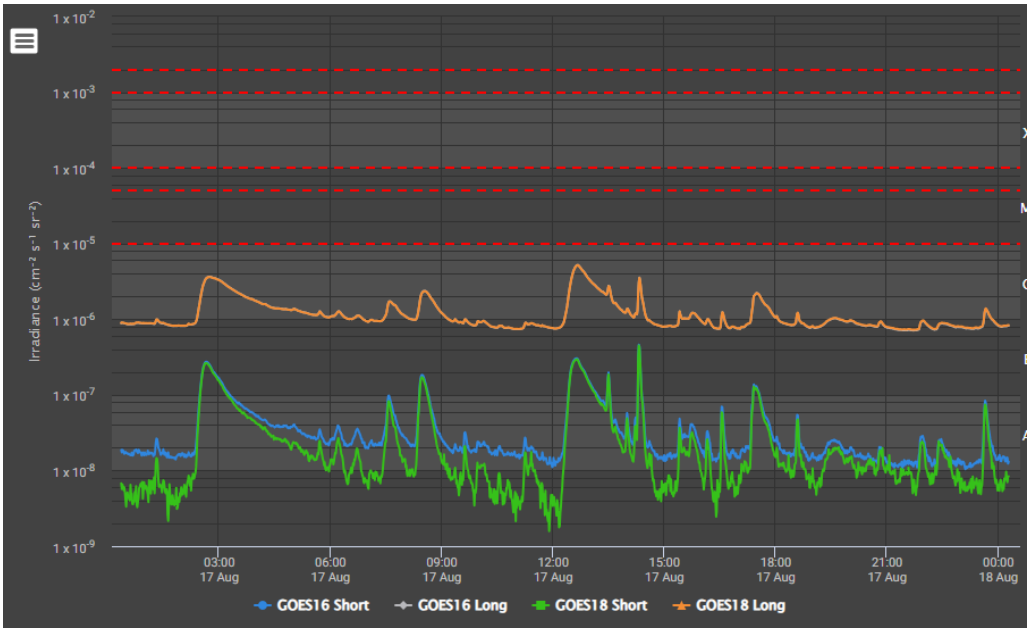
Low solar activity is expected to persist, but with a chance of rising to Moderate due to isolated M-flares. The eleven regions currently on the visible Earth-facing disc are generally stable, either small unipolar, or simple bipolar spots.

The most notable of these include AR3403 the northwest, and AR3407 in the south centre and AR3405 in the northwest. AR3403 has seen some penumbral growth of its leader and the nearby located small spot AR3409 adds some slight but additional complexity. AR3409 also briefly saw a nearby spot develop to its south, however this has now largely faded, and it remains a simple and moderately sized bipolar group with small intermediate spots. AR3405 in the northeast is a longitudinally wide but simple looking spot, however SDO imagery shows an attached filament with a subsequent small potential-sigmoidal signature. Any eruption of this filament brings a risk of M-flares.

Far-sided products, show the potential for a notable region to return onto the eastern limb day 2 (19 Aug) and this may increase activity later in the period, giving an increased potential for M-flares.

X Ray Flares	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability			(%)	(%)	(%)	(%)
Active	R1-R2 M Class	No	30	35	40	40
Very Active	R3 to R5 X Class	No	1	1	1	1

Figure 3: GOES-16/18 X-ray flux



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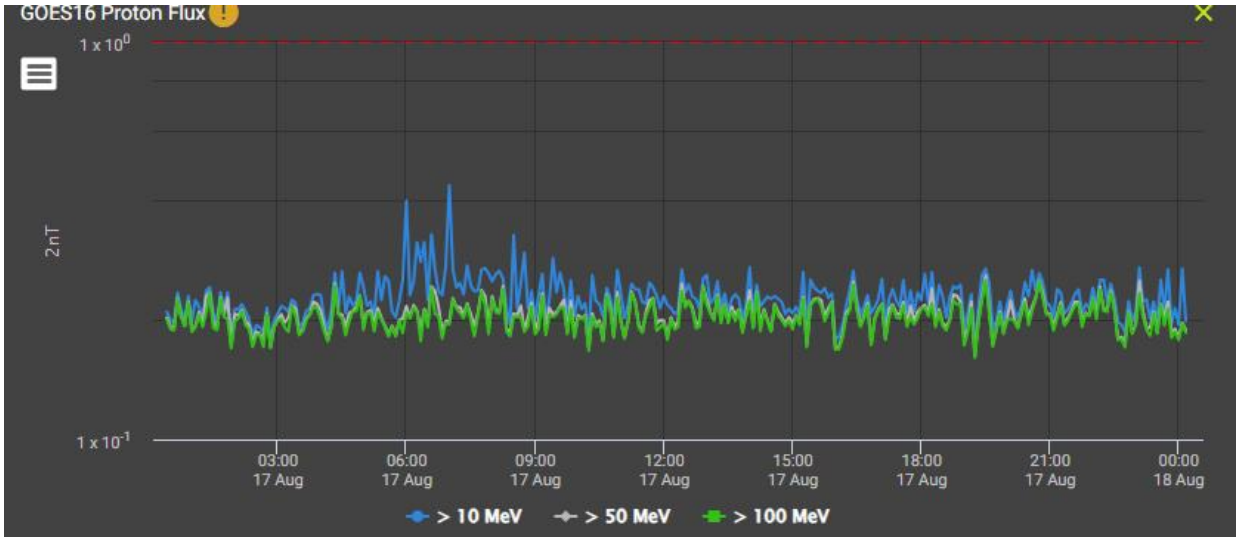
Solar Radiation Storms - (High Energy Protons):

High energy (greater than 10MeV) proton flux observed by GOES-16 has been mostly at background, however a very slight increase was observed above this level around 17/0600-0900 UTC due to an eruption on the southwest limb.

There persists a small chance of further slight increases from any significant flares, predominately from the western hemisphere or over the limb, however this is unlikely to reach S1 Minor Storm.

Radiation Storms Probability (Exceedance)	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ S1**	No	2	2	2	2
Very Active	**≥ S3 ***	No	1	1	1	1
* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)						

Figure 4: GOES-16 >10 MeV >50MeV and >100 MeV proton flux showing very weak enhancement



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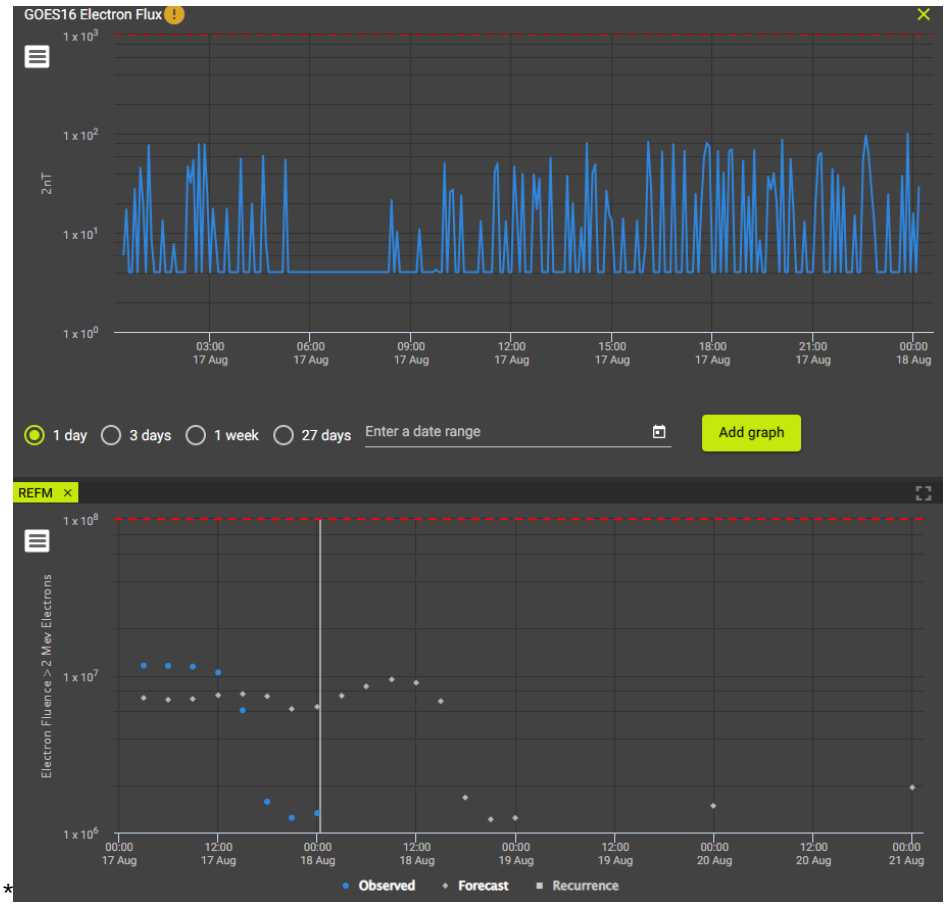
High Energy Electrons Event (≥ 2MeV):

The high energy (greater than 2 MeV) electron flux is at background, and with no significant solar wind enhancements through the period is expected to remain at this level throughout. There is a slight chance of rising to Moderate at periods of diurnal maximum.

The associated 24 hour fluence is expected to remain well below the Active threshold, as supported by REFM which is currently giving good guidance.

GEO Electron Environment Probability (Exceedance)	Level (cm^{-2} sr^{-1} day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ 2 MeV ≥ $1x10^8$**	No	1	1	1	1
Very Active	**≥ 2 MeV ≥ $1x10^9$**	No	1	1	1	1

Figure 5: >2MeV Electron flux and associated fluence with REFM



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